DOE Distributed Energy Peer Review – December 2 – 4, 2003

Verizon's 'CO of the Future'

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Upcoming Fuel Cell DER Demonstration Projects

Phase I - Large Central Office (CO)– Garden City, NY 2004

Phase II - Medium CO – Rome, NY (CO of the Future) 2005

Overall Project Purpose and Objectives: To introduce and demonstrate fuel cell technology DER applications to Verizon's central office (CO) infrastructure in a methodical phased manner. Phase I (the Garden City FC Project) is an AC based application tied into the commercial grid, and Phase II (the Rome CO of the Future) is a DC-to-DC based application to Verizon's landline network. Phase I is anticipated to achieve an overall efficiency of 44.12%, and Phase II is anticipated to achieve an overall efficiency between 50 – 60%.

Phase I of the CO of the Future Initiative: Garden City CO Fuel Cell Project, 741 Zeckendorf Blvd., Long Island, NY

332,115 square feet, 1350 employees, 3 switches, training school, premium operations

Environmental Climate/Evaluation

Electric and Natural Gas Costs

DC to AC to DC Power Integrated with the Grid

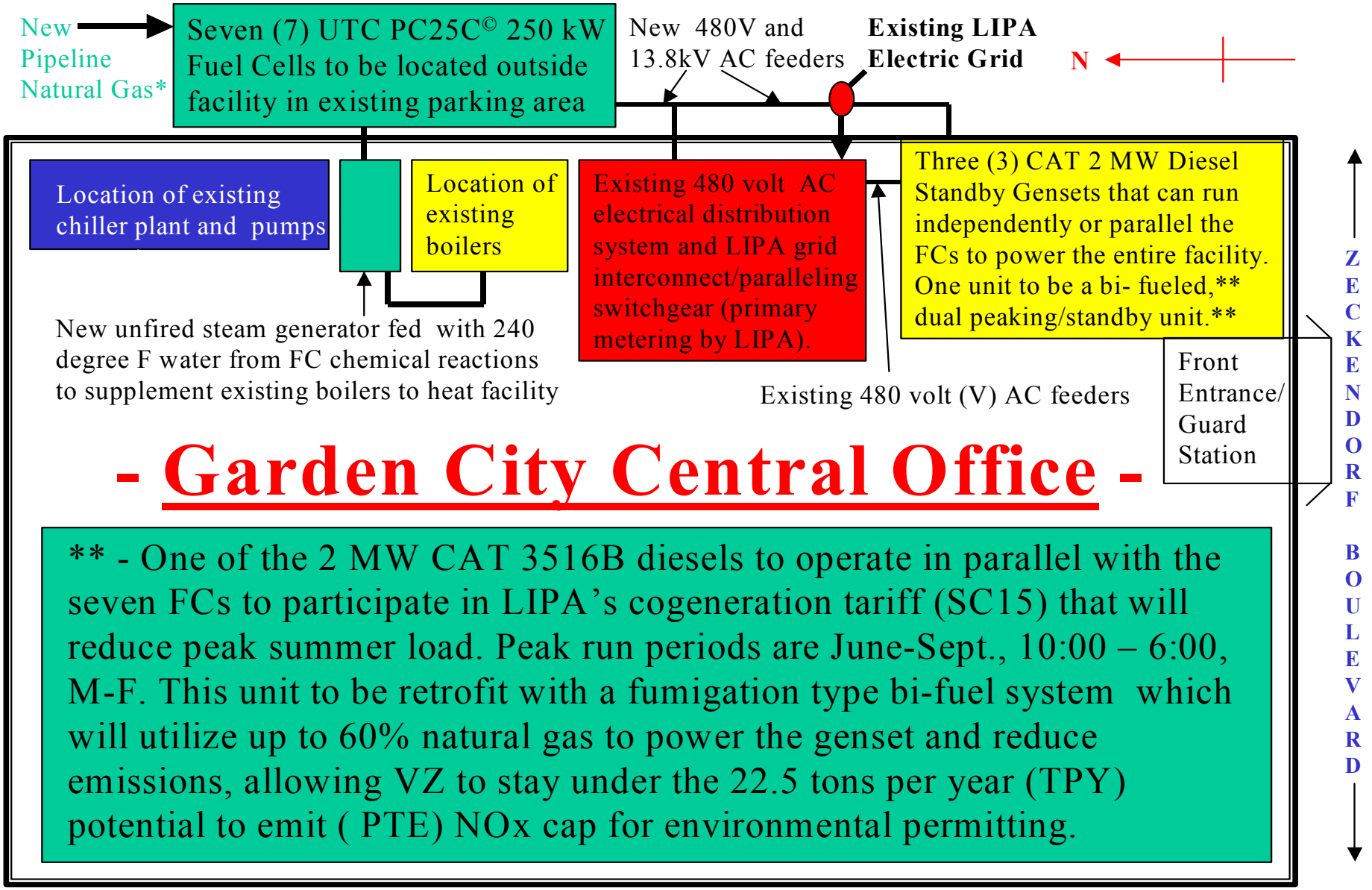
Established Fuel Cell Technology in VZ - Phosphoric Acid

Phase I - Garden City Central Office Fuel Cell Project, Long Island, NY

- 04/07/03 - Re-scope design kick-off
- 05/31/03 - Obtain final LIPA interconnection approval
- 06/01/03 - Environmental permit for Garden City CO received from NYS DEC
- 07/18/03 - Re-scope design by KBS 100% complete
- 07/25/03 - Determine KEM fixed price based on 100% design
- 08/01/03 - Sign Design/build/maintain contract with KEM
- 09/15/03 - KEM releases all final equipment fabrication orders
- 10/31/03 - Obtain local township final approval to construct*
- 11/01/03 - Construction Start
- 03/16/04 - Commissioning/Acceptance Testing Start
- 06/01/04 - Ribbon Cutting Ceremony/Power Plant Start-up
- 09/30/04 – Complete documentation of project for dissemination to industry

1.4 Megawatt Fuel Cell Distributed Generation System

Seven phosphoric acid fuel cells that normally operate in parallel with the grid, and in parallel with the standby power plant in peaking or standby mode, for a robust, clean, highly available distributed generation power supply.



Expected Learning: Operation of Fuel Cells with inverter generated AC output in parallel with either the electric grid or Verizon's diesel based standby plant

Phase II of the CO of the Future Initiative: Rome CO Fuel Cell Project, 137 Washington St., Rome, NY

- *PRFP to secure FC, DC:DC converter and thermal/heat reclamation equipment sent to seven (7) FC vendors on 8/20/03.*
- *DC to DC power, up to 70% overall efficiency*
- *Prototype of future telecommunications facility CO power upgrade design option to costly electrical service entrance upgrades*

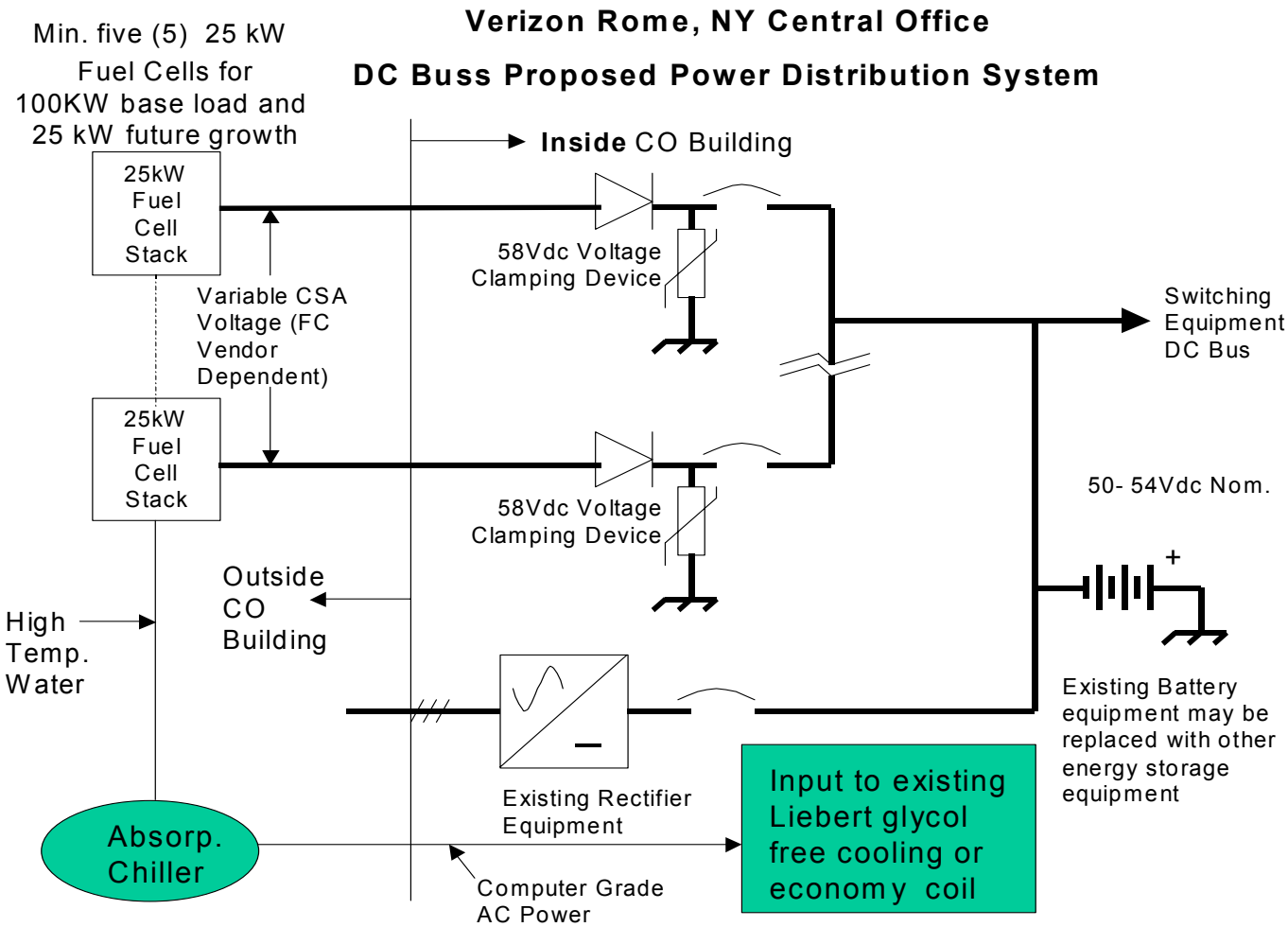
Phase II - Rome CO of the Future Project (Rome, NY)

- 06/15/03 – Re-scope design kick-off meeting with full team
- 09/12/03 - Secure budget pricing on FC modules
- 11/03/03 - Detailed design for installation of fuel cell complete
- 12/08/03 - Estimate case/budget funding approval *
- 06/18/04 - FC vendor receives NEBS testing approval for DC generator module *
- 09/20/04 - Select/Pre-Qualify Real Estate and Network Engineering EFI Vendor(s)
- 10/21/04 – Obtain local township final approval to construct*
- 11/01/04 - Construction Start
- 03/27/05 - Commissioning Start
- 04/21/05 - Construction Complete
- 05/27/05 - Ribbon Cutting ceremony/Power Plant Start-up

- 09/30/05 – Complete documentation of project for dissemination to industry

Central Office of the Future: Rome, New York

- *Two story 36,000 square foot building*
- *45 Live Source Center Employees*
- *100 kW DC load (300 kW total AC load)*
- *Natural gas available*
- *Environmentally and economically sound*
- *Energy efficient Telecom equipment*



<u>Expected Learning:</u> Operation of fuel cells with their DC output in parallel with rectifiers, and utilization of the heat generated by the fuel cells to produce chilled water via an absorption chiller for cooling switch space.

Central Office of the Future: Phase II, Rome, New York Schedule

- ***RFI package to fuel cell and power equipment vendors for DC equipment*** — ***09/03***
- ***NEBS testing of FC and DC:DC equipment complete*** — ***06/04***
- ***Installation of FC to power –48 V DC telecom equipment bus complete. Albany Airport demonstration 7/03 has show this DC to DC can be done.*** — ***04/05***
- ***Complete study on FCs as alternative to CO electrical service entrance upgrades*** — ***09/05***

Major partners and the role they play in its completion:

- KeySpan – Phase I Design/build and maintain FC based DER power plant.
- UTC Fuel Cells – VZ Preferred Vendor for purchase of commercially available FCs
- Telcordia – Phase II Specifications for FCs acting as a DC generator and Industry/USTA dissemination efforts
- Robson Woes Group (RWGroup) – Phase II design of FC installation at the Rome CO.
- University of Buffalo – FC waste heat reclamation strategy working with RWGroup.

FY 2003 Results and Accomplishments

- ***Phase I - Garden City Central Office Fuel Cell Project, Long Island, NY***

  - 04/07/03 - Re-scope design kick-off
  - 05/31/03 - Obtained final LIPA interconnection approval
  - 06/01/03 - Environmental permit for Garden City CO received from NYS DEC
  - 08/08/03 - Re-scope design by KBS 100% completed
  - 09/30/03 - Determined KEM fixed price based on 100% design
  - 11/10/03 - Obtained local township final approval to construct* **- Just announced to Team on 11/10/03!**

- ***Phase II - Rome CO of the Future Project (Rome, NY)***

  - 06/15/03 – Re-scope design kick-off meeting with full team
  - 10/07/03 - Secure budget pricing on FC modules

Key Technical Barriers and Strategy to Overcome Them

Identification of any possible voltage or current instabilities that may arise in operating the DC output of a FC in parallel with Verizon's rectifiers – this will be overcome by incorporating Network Equipment Building (NEBS) testing of the integration components (DC:DC chopper or voltage regulation device). The final test will be a fire/flammability rating test (destructive type testing) on one of the NEBs practices are the Telecom Industries highest standards for safely and reliably integrating equipment to the network.

Key Technical Barriers and Strategy to Overcome Them (continued)

Most efficient way to reclaim heat from FC vendors who submitted a DC based FC generator proposal in response to Verizon's recent RFI and RFP processes – This will be looked at closely by University of Buffalo representatives and Verizon's Technology Organization (VTO).

Key Technical Barriers and Strategy to Overcome Them (continued)

It was hoped to utilize a high temperature FC for phase II, but after going through and extensive RFI/RFP process, the Team learned that this would not be feasible based on the RFI/RFP responses. This introduces a technical barrier of how to best reclaim the heat. The Team has already started to tackle this barrier by benchmarking worldwide with other FC technology adopters in the Telecom industry, namely Nippon Telephone and Telegraph (NTT). Based on recent benchmarking efforts, it is encouraging to find out that overall, Phase II is technically in alignment with what NTT second phase demonstration FC projects are attempting to complete.

Project Risks

The projects are being managed to minimize and mitigate risk exposure to VZ by retaining existing systems through the new demonstration project equipment ‘prove in’ period which is to be determined. Verizon will not do anything to decrease the current overall availability and reliability of our network to our customers.

Impact of Project On Verizon's DER Program

This project contributes to the achievement of the U.S. Department of Energy's Distributed Energy Program goals by introducing environmentally 'clean' DER/DG projects to Verizon's portfolio of capital projects. Senior management will be kept abreast of the results by way of an Energy Board of Directors (BOD), which will set the stage for future DER/DG projects in Verizon's footprint. Phase I alone is anticipated to reduce GHG emissions (CO2) by 12 million pounds per year. Phase I will demonstrate the maximum efficiency that can be achieved when applying a FCs DC based output directly on Verizons DC bus that powers it's network. Ultimately, this will reduce the nations dependence on foreign fossil fuel reserves for centuries to come. These projects also foster teamwork between the Electrical and Telecom Industries to come up with solutions that can help the US address future grid availability issues that the events of August 14, 2003 brought back into focus.

Reasons for Exploring and Using New Energy Sources

- *A Commitment to the Environment*
- *Energy Reliability and Its Effect on Providing Service*
- *A Huge and Growing Energy Use (Over 5.1 Billion kwh Annually at Verizon)*
- *Decreased U.S. Dependence on Foreign Energy*
- *Being Ready When Being Ready Is NECESSARY!*

Summary

- These projects are the catalysts for a major paradigm shift in how the telecom industry powers it's networks, and is a wake up call for change.
- It is anticipated that these projects will open the door for other types DER resources including DC based renewable power sources such as solar and wind.